Vol 3-Sep2018
ISSN: 2541-3023

Utilization of Waste Stem of Oilpalm For The Manufacture of Particle Board Composite Sound Absorbency

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Abstract. A common problem experienced by people in Indonesia is the increase in pollution, one of which is noise pollution (noise). Therefore, in this study a composite board is intended to be used as a sound absorber. This study aims to determine the acoustic properties of particle board made from palm frond waste. Composite boards are made from palm oil midrib waste using urea formaldehyde matrix as an adhesive. The composite board is made with 10%, 15% adhesive fraction and then the absorption coefficient test is carried out. The results obtained in the test showed that the average board density obtained was 0.402 g/cm^3, 0.601 g/cm^3 and 0.922 g/cm^3 for the 10% adhesive board while for the 15% adhesive the average board density produced was 0.406 g/cm^3, 0.618 g/cm^3, 0.955 g/cm^3. Judging from the resulting particle board included is in the category of medium quality particle board. For testing the absorption of particle board produced at a frequency of 500 Hz as the mean of 0.9, it is included in the category of high-quality particleboard according to ISO 11654 standard.

1. Introduction

Activities in the community cause various problems, such as the pollution of noise. Currently there are many materials in the market that can reduce noise such as glass-wool, rockwool and gypsum, but that materials are very expensive so people try to find other alternatives by making of cheap, practical and widely available materials in nature. One of them is palm fronds.

Oil palm plants produce 3 main types of waste, namely palm fronds, palm oil sludge and palm kernel cake. This waste is quite abundant throughout the year, but its use has not been maximized, especially as an industrial material.

Technology in the material field is sustainable develop. Humans need material to be used in a variety of purposes. For this reason knowledge and technology are needed to make maximum use of natural resources. Basically, the advantages of each material cause the development of material use. For example, at this time we need materials that are cheap, lightweight, strong, and easy to obtain. Therefore, currently material commonly referred to as composite material is developing, which is a composite material of several types of material, which turns out having different characteristics with the nature of the main material after two different types of material were combined.

The results of Khuriati et al research on "Absorption of Sound Waves by Sound Absorbers Made from Coconut Fiber Composite Materials" show that coconut fiber meets the requirements for sound absorbers according to ISO 11654, namely with a sound absorption coefficient (αw) above 0.15. In addition, Setyanto et al stated that composite sound absorption panels made from paper waste and coconut fibers have a sound absorption coefficient of 0.25 at the reference frequency (500Hz) and have met the minimum standard of sound absorption coefficient based on ISO 11654: 1997. Fatimah et al also stated that composites from betel bark fibers can absorb sound with an average absorption coefficient value of composite boards obtained respectively 0.11; 0.06; 0.05 and 0.06 for adhesive fractions 10%, 15%, 20% and 25%. This is in accordance with the standards set by ISO 10534-2: 1998 (GB / T 18696.2-2002) that a material is categorized as being able to absorb sound if it has a sound absorption coefficient greater than 0.05.

Vol 3-Sep2018
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Utilization of solid waste of oil palm fronds as the basic material for sound absorption particle board is expected to be one solution to the problems of oil palm plantation waste, the development of particle board products and problems related to the environment and pollution.

2. Materials and Methods

2.1 Materials and obtained samples

We use raw materials in the form of palm frond waste from oil palm plantations in Riau Province. The midrib obtained is given a treatment in the form of a reduction in water content and grinding to get the material in the form of decomposed fibers. In this study the experimental design used was a completely randomized design pattern (Completely Randomized Design) with factorial experiments. The factor used consists of two factors, namely the amount of adhesive P1 = 10%, P2 = 15% with the target board density K1 = 0.4 gr / cm3; K2 = 0.6 gr / cm3; K3 = 0.9 gr / cm3.

Figure 2.1 Oil palm fronds

2.2 Physical characterization

For testing the physical properties, the tests carried out are testing the target density which refers to the standard SNI Number 03-2105-2006.

2.3 Sound absorber Characterization

Composites in this study are intended for room partition panel applications. And it is expected that the room partition panel has sound absorption capability as indicated by the sound absorption coefficient value. To find out the sound absorption coefficient owned by composite particle board, sound absorption test was carried out using 2 microphones impedance tube test based on ASTM E1050-98 test standard.

3. Result and Discussion

3.1 Physical Characterization

Particle board density testing is carried out using a test material with a size of 10 x 10 cm. The test results of particle board density obtained can be seen in Figure 3.1.

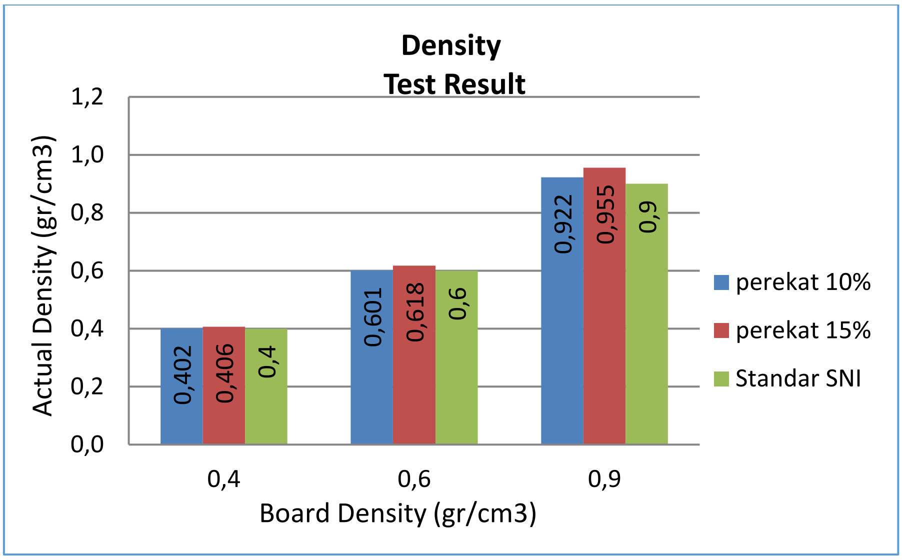

Figure 3.1 The results of particle board density test

The intended density in this study was 0.4 gr / cm3, 0.6 gr / cm3 and 0.9 gr / cm3, but the results achieved on average exceeded the intended density. The highest yield was 0.955 gr / cm3 at a density of 0.9 with an adhesive amount of 15%. Based on the data we obtained the resulting particle board fulfilled the desired density target. This can be caused by pressure presses that are high enough to make particle boards from palm fronds fibers.

3.2 Sound absorber Characterization

Sound absorption coefficient owned by composite particle board, sound absorption test was carried out using 2 microphones impedance tube test based on ASTM E1050-98 test standard. Here is a graph of the absorption coefficient of the test results:

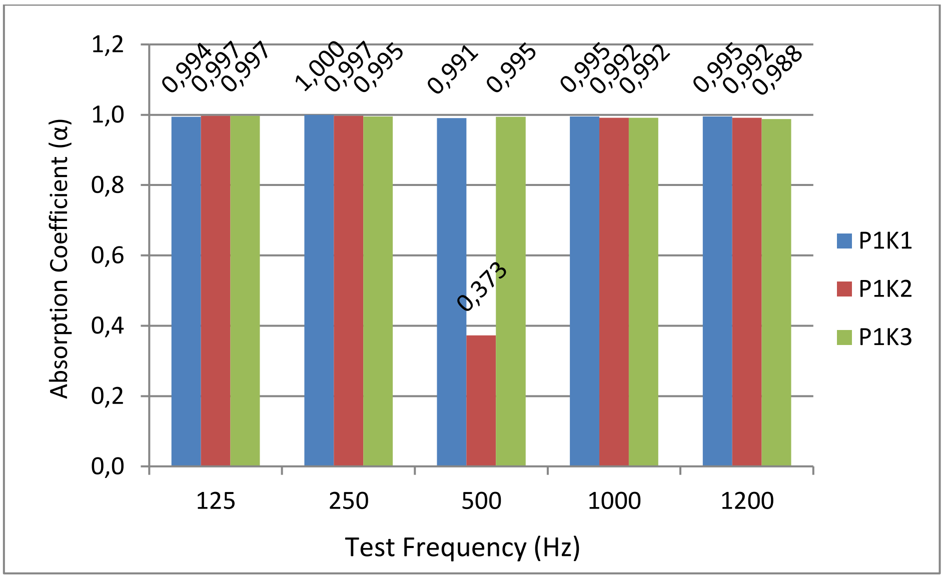

Figure 3.2 sound absorption test results with 10% adhesive

Absorption testing is carried out at a frequency of 125Hz - 1200Hz, considering the flexibility of the panel (the panel has a soft surface), so testing at frequencies above 1200 Hz is less necessary (the test results generally show numbers that are always stable at small absorption coefficients for high frequency sounds).

Graph 3.2 shows the variability of the absorptive coefficient. On the panel with a 10% adhesive density of 0.4 g / cm3 the absorption coefficient produced is relatively stable from the lowest frequency to the highest frequency due to the low particle density and the porous board surface so that the absorption capacity is high. For 0.6 g / cm3 density particle board, the resulting absorption coefficient varied, ie stable at low frequencies, continuously decreasing and reaching the lowest point at a frequency of 500 Hz, then rising again. But on the panel with a density of 0.9 g / cm3 the absorption coefficient value tends to continue to decline, as the sound frequency is tested. The NRC value of each ingredient is: at 0.4 g / cm3 is 0.995, on the panel with a density of 0.6 g / cm3 is 0.870 and on the panel with a density of 0.9 g / cm2 is 0.993.

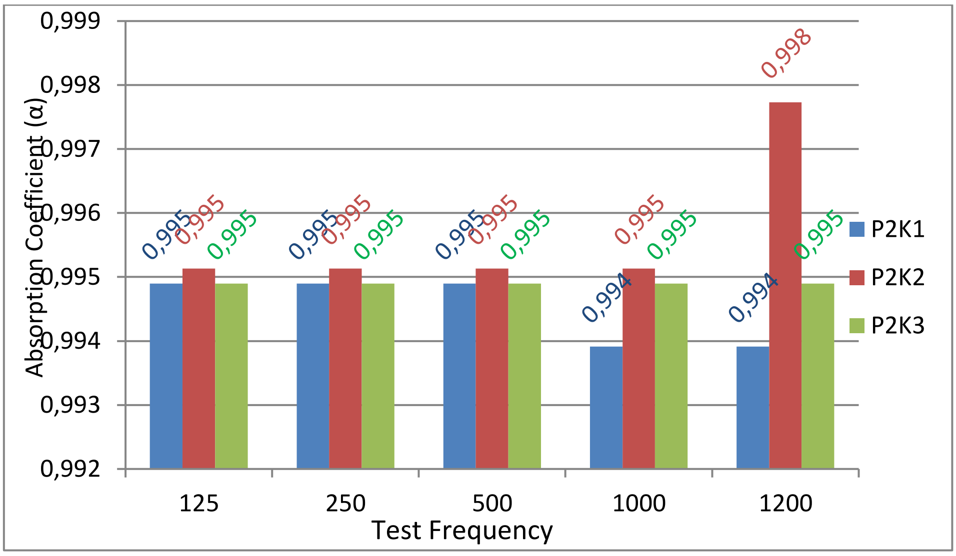

Figure 3.3 The results of sound absorption test with 15% adhesive

Figure 3.3 shows the variability of the absorption coefficient. In the panel with a density of 0.4 g / cm3 the resulting absorption coefficient is relatively stable from the lowest frequency to the intermediate frequency but has decreased in high frequencies, namely at the frequency of 1000 - 1200 Hz this is due to the increase in adhesive content so that the absorption capacity is reduced. For particle board with density of 0.6 g / cm3 the absorption coefficient produced was relatively stable, but experienced a very drastic increase in the frequency of 1200 Hz. While on the panel with a density of 0.9 g / cm3, the absorption coefficient value has a stable absorption. The NRC value of each material is: The panel with a density of 0.4 g / cm3 is 0.995, on the panel with a density of 0.6 g / cm3 is 0.995 and the panel with a density of 0.9 g / cm3 is 0.995.

4. Conclusion

We observed that panels made from oil palm midrib have excellent sound absorption capability. With various variations of adhesive content and density, satisfactory results were obtained. From the results of testing the physical properties it was found that all test specimens were able to meet the intended target density, while the results of the sound absorption test analysis showed varied absorption coefficient values. On the panel with 10% and 15% adhesive, the resulting absorption coefficient is quite satisfying, referring to the ISO 11654 standard on acoustics, the average panel produced has an A classification that is with αw between 0.9 - 1.0.

5. Acknowledgement

The author would like to thank Muhammadiyah University of Riau (UMRI) for supporting this experimental work and also for the financial support given.

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ISSN: 2541-3023

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